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WHAT DO YOU MEAN, "SITE PREPARATION?"

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ABSTRACT

Successful regeneration of many forest tree species requires some mineral soil exposure or disturbance, commonly referred to as site preparation. The amount and nature of this soil disturbance depends on local conditions, silvical requirements, and costs. Because there are many ways in which a forest area can be treated and because the forester must strive to prevent soil loss from the site, an understanding of site preparation terms is important. An attempt is made to set forth and describe the methods frequently used by foresters in the course of preparing ground for regeneration.

Site preparation, or purposely disturbing the forest floor to encourage the establishment and survival of tree seedlings, will probably become common practice in the years ahead. It is already employed in some regions and types of ownership, especially where soil moisture in the growing season reaches critically low levels. Because site preparation involves such an important and indispensable medium, it would appear appropriate to designate, with explanation, the operations which produce this soil rearrangement. Definitions of site preparation terms are now either unavailable or vague. They would be useful for those engaged in either research or operational aspects of forest site preparation for purposes of clarity in common understanding.

The intensiveness of silvicultural practice has probably progressed more in the last 10 years than it did in the previous 50. Many factors are responsible but there is no gainsaying the fact that sustained yield, as applied to forest crops, has become more

than an obscure goal, a hackneyed textbook phrase, or a magic term bandied about enthusiastically in the secluded atmosphere of professional meetings. One of the facets of silviculture that has been appreciated and practiced during this same period is the indispensable role of forest regeneration. Problems of tree regeneration always have claimed and always will claim the attention and exertions of silviculturists; yet, often this logical and sometimes difficult task of mature crop replacement was left to hope. Hoping was not enough.

Some degree of site preparation is usually needed to start a new crop of most forest tree species, especially conifers; this is an integral and important part of silviculture (8). Site preparation should achieve two main objectives: exposure of mineral soil in desirable amount with acceptable distribution, and reduction or elimination of live competition. Mineral soil is the most suitable growing medium for tree seedlings because of its abundance, its moisture-holding capacity, and the ease with which roots can penetrate it. Where site preparation loosens the soil, water percolation rate may be increased and the opportunity for initial seedlings root penetration enhanced. It should be noted that making mineral soil available and eliminating vegetative competition do not, per se, guarantee natural regeneration.

In regions where summer rainfall is usually ample, as in New England, tree seedlings can establish themselves in competition with other vegetation; nevertheless, they would grow better if they had no competition. When moisture becomes critical during the growing season, as it does in some of the forest regions that support high volumes per acre, it may become necessary within the bounds of reasonable cost to eliminate all competing vegetation. This operation requires much soil cultivation, or at least that it be laid bare. Subsequently, on level ground, soil erosion is no great problem because it results chiefly from wind action; but on sloping ground soil movement may be serious because of overland flow of surface water.

A large area of forest ground is treated each year, perhaps 1,000,000 acres;[1] this area is increasing annually. Any manipulation of the forester's basic asset, forest soil, requires knowledge and skill if it is to serve its purpose. Furthermore, land that supports a specific type of growth for a long period of time reaches a degree of ecological balance. When site preparation is carried out, this balance is suddenly and drastically disturbed. Unless the silviculturist is aware of the possible results of his planned disturbance, he can bring about a vegetational change that may be as severe (i.e., as competitive) as the very one he is attempting to eliminate. This disturbance can also start or increase erosion. Thus, timing and degree of site disturbance are linked and of great importance.

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[1] No precise figures on area of site preparation are available. Meyer (13) cites 200,000 acres as a conservative estimate of annual area of site treatment by 21 industrial organizations in the Southeast.

The disturbance of the forest floor caused by logging may be insufficient in amount or in location to result in seedling establishment, and there is often slash to hinder germination, seedling growth, and accessibility. Planned site preparation is invariably needed.

Forest site preparation is accomplished by mechanical means, by use of fire, and by chemical treatment, or by a combination of two or all three. These three methods of site preparation have been greatly developed and even refined in recent years.

Heretofore, hand scalping, disking, and plowing have been the common ways of preparing ground for natural regeneration or for seeding and planting. These methods resulted in partial elimination of competition and limited exposure of mineral soil. Forest land from which mature timber has been removed or land that is to be reclaimed is now treated more efficiently and economically by tractors of all sizes with various attachments, some of which are specially designed for site preparation. The amount of mineral soil exposed in these operations varies from perhaps 20 to as much as 100 percent, depending on the terrain, the cover, and the requirements of the tree species being established. At present, use of machinery is confined to slopes less than 40 percent whereon the ground or the vegetation on it can be disked, furrowed, stripped, ripped, punched, slitted, dragged, chopped, tilled, churned, hogged, or crushed (5, 10, 1, 15, 9, 2, 14, 19, 20, 3, 12, 11).

Animal power, though limited in scope, is used occasionally. Also, the planned and unplanned herding of different domestic animals has resulted in ground preparation, with varying degrees of success. This latter type of site preparation is difficult to control.

Fire has been used for many years in silvicultural work on a technically planned basis to rid areas of logging slash and of accumulated litter. The various methods of slash disposal and use of fire adapted to specific silvicultural needs are well known and are described adequately elsewhere (7, 16). Successful use of fire as a means of site preparation requires unusual skill and a generous measure of luck. If carried off as planned it can be economically worthwhile in ridding areas of debris and exposing mineral soil; but fire can also be ineffective when overcaution is exercised and occasionally becomes destructive and expensive when calculated risks are taken, as they must be. Nevertheless, fire is, and probably will remain, a cheap and a satisfactory means of site preparation, especially in coniferous forests where slash disposal and hazard abatement are required.

During the last decade tremendous strides have been made in the use of chemicals to dispose of unwanted vegetation. The well-known formulations of 2,4,5-T and 2,4-D have been and are being widely used in all parts of the continent (4). They are applied commonly by ground-pumping units (18), but they are also applied by aircraft at reasonable cost and with satisfactory results. It is sometimes necessary to spray the same area more than once to achieve a complete kill of the vegetation (6). After the undesirable vegetation is killed by phytocides it is sometimes burned (17). Sometimes

it can be windrowed by machine or perhaps crushed to facilitate and make safer its subsequent disposal by burning and the mechanical treatment of the soil (17). Shallow-soiled sites where mechanical treatment would be too harsh can be more safely and satisfactorily treated by chemicals to reduce or eliminate competition; such areas should not be clear cut. On such sites, spraying by use of ground-based machines has proved feasible (18).

All treatments of site have a common objective: to bring about germination of sufficient seed per acre and/or survival and acceptable growth of enough of these or planted seedlings per acre to form a new stand of desired species. The achievement of this objective depends on the usual requirements for plant growth and also on the amount of seed, numbers of predators, and the competition from weed seeds and sprouts on the site during the first and subsequent growing seasons. The time when sites are prepared will depend on the soil, the climate, and the silvical requirements of the tree species being established. In the West, the summer or fall prior to the year of stand establishment is preferable for site preparation because most of the soil settling occurs before the following spring. Seed that has fallen on freshly and uniformly scarified ground is covered with soil by the action of rain, gravity, and wind. For most tree species, seed that is covered by soil is more likely to germinate and grow than if it remained on the soil surface.

Forest site preparation can be defined as the treatment of soil and ground cover or slash on it, by hand, machinery, applied chemicals, or fire, or a combination of them, to prepare the soil surface for favorable reception to either naturally disseminated or artificially sown seed, or to planted seedlings.

A. COMPLETE SITE PREPARATION. The entire area is treated preparatory to regeneration by either artificial or natural means.

1. Machinery. The site may or may not be scarified (16), but the entire area (except ground occupied by stumps, large boulders, and collected debris) is scalped. Scarification can be done on level ground and on slopes up to 35 percent with a variety of equipment. On sloping ground, areas are worked from the uphill side and along the contours to keep later soil movement to the minimum. Usually, all vegetation and debris are removed and pushed to the perimeter of the area or into windrows or into ravines.

2. Fire. Usually fire is employed to dispose of (a) logging slash and (b) vegetation already killed by either mechanical or chemical means. This amounts to controlled burning over the entire area.

3. Chemicals. Phytocides are used to eliminate or to reduce greatly the vegetative competition on the area. Initial treatment may be followed by an additional application of chemicals, use of fire, or mechanical treatment.

B. PARTIAL SITE PREPARATION. Only a part of the area to be regenerated is treated. Usually, but not always (or entirely), treatment is for the purpose of promoting artificial regeneration.

1. Machinery

a. Scarification. Commonly done by rakes, rippers, or discs. Most of the area is scarified, but not all live vegetation is removed. It is a purely mechanical operation over the entire area, and some vegetation escapes the scarifying device. Scarifying can be done in the process of machine piling and burning of logging slash. Sloping ground should be scarified along contours.

b. Strips, furrows, trenches. Plows throw the turned soil to one side; trenchers throw it to both sides. Commonly done by dozer blades, front- or rear-mounted plows and discs, or trenchers on tractors working along contours. Stripping removes the top layer of soil together with the seeds in it and the plants on it. There is less competition immediately following stripping than after furrowing or trenching. The deeper the stripping, the more enduring the effect.

The precise arrangement of the treated parts of the site will vary; some parts are left untreated because they are either not needed for acceptable stocking of forest trees or, on steep ground and erosible soil, they serve as barriers to movement of water and soil. In preparing sites above stream bottoms, untreated ground should always be left as a buffer to soil movement.

For greatest usefulness, furrows should be made along the contours to minimize horizontal and downhill movement of water. On sloping ground, contour furrows[2] are made, and for machine planting the furrow slice (side cast) is thrown downhill so that the planting unit will ride level. This lessens the competition against the sown seed or planted seedling and guides moisture to the tree's roots.

c. Terraces. Contour terraces,[3] commonly the width of the tractor that is doing the work, are constructed along contours where it is

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[2] See "Furrows" and "Terraces" (16, pp. 35, 87). Both contour furrows and contour terraces are defined as being constructed to check runoff and soil loss. Their purpose as described here is to provide a stable structure in which to grow trees, an entirely different function. Actually furrows and terraces can be dual-purpose structures.

[3] Ibid., p. 87.

desirable to reforest steep (35 percent and over) sidehills. Seeding or planting is done directly on the newly created surface. Terraces slope slightly inward to hold moisture and keep soil movement to the minimum. They are expensive and hazardous to construct and require unusually skilled operators.

2. Fire. Fire is used to dispose of slash or live or dead vegetation over part of the area either because it is a fire hazard or because it interferes with the establishment of reproduction.

3. Chemicals. Phytocides are applied only to that part of the area where reproduction is intended or to certain plants that are to be eradicated from the area.

4. Manual labor. Part of the site is prepared by individually made scalps (16, p. 35) and pits. For scalps, live and dead vegetation is removed from a small (usually about 30 by 30 inches) spot to facilitate the sowing of seed or planting of a seedling and to reduce or eliminate vegetative competition with the seedling; for pits, shallow depressions or basins are made, in which planting is done manually.

A pit is free of debris and vegetation; in its deepest part, moisture is guided towards the planted tree. On steep ground these pits are made level to avoid soil washing and also to prevent water from moving soil away from the planted tree. Soil directly uphill from the pit must necessarily be removed to prevent its sloughing, filling the pit, and burying the tree. This soil removal should leave a convex rather than a concave surface directly above the tree; otherwise water and soil from heavy storms will collect and channel into the pit.

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